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## LIGATION OR EXCISION OF THROMBOSED VEINS IN THE TREATMENT OF PUERPERAL PYEMIA.\*

BY

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It is generally recognized that the extension of puerperal infective processes from the endometrium usually occurs through the lymphatic or venous channels, giving rise to lymphangitis or thrombophlebitis as the case may be.

The former usually terminates in general peritonitis, while the course of the latter will depend in great part upon the virulence of the offending bacteria, as well as upon the resisting powers of the patient. When large numbers of virulent streptococci gain access to the gaping veins at the placental site, only slight changes occur in the vessel walls and the patient rapidly succumbs to general septicemia, the so-called sepsis foudroyante or acute pyemia. If, on the other hand, the bacteria are of lesser virulence or the resistance of the patient is exceptionally good, a suitable medium for bacterial growth is found in the thrombi closing the torn ends of the uterine veins, with the result that typical phlebitis develops and is accompanied by extensive thrombus formation. The process may remain limited to the veins of the true pelvis or more frequently extends upward along the spermatic and hypogastric veins, and may eventually lead to thrombosis of the common iliac or even of the vena cava beyond the point of entrance of the renal veins.

In such cases the thrombus formation may undergo liquefaction, when particles containing streptococci are carried as emboli to various portions of the body and give rise to metastatic abscesses wherever arrested. The process is then designated by the old name of pyemia, and is characterized by a typical hectic temperature and the occurrence of frequent chills.

It is difficult to give exact figures as to the comparative incidence of chronic pyemia, but it is safe to say that its lesions

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can be demonstrated in at least one-third of all autopsies upon women dying from puerperal infection. Thus, Kneise in eighty-nine such autopsies at Halle reported that the principal lesion was peritonitis in forty-three, thrombophlebitis in twenty, pyemia in seventeen, parametritis in seven and sepsis foudroyant in two cases. Lenhartz stated that pyemia occurred in one-half of his cases, Trendelenburg noted it in twenty-one out of forty-one autopsies performed in Dresden during the course of two years; while Grossmann and Seegert reported fourteen and thirty-one cases in fifty-one and eighty-one autopsies, respectively.

As has already been indicated, the condition is usually characterized by a hectic temperature and the occurrence of frequent chills. The temperature and pulse may present marked remissions; the former rising as high as 106 and 107, and falling below normal within the course of a few hours. During the remissions the patient may feel perfectly well and appear desperately ill during the exacerbations. Abscesses may develop in any portion of the body, particularly in the lungs, liver, kidneys, joints, or eyes, and many patients perish from the prolonged suppuration incident to the metastatic processes rather than from the primary lesion. The duration of the disease varies from a few weeks to many months, and I have seen patients recover after successively going through pulmonary abscess, metastatic panophthalmia and the opening of multiple joint abscesses. Indeed, the apparent severity of the clinical symptoms may afford no indication as to the outcome of the case, as Seegert has reported the occurrence of spontaneous cure after as many as seventy chills, while one of my patients died without a chill or an alarming rise of temperature, and yet at autopsy a solid thrombus was discovered which extended from the dorsum of the foot to the vena cava beyond its junction with the renal vein.

Leaving out of consideration the benign form of femoral phlebitis—phlegmasia alba dolens—less than one-third of my patients recovered under expectant treatment. A study of the literature shows that the statements concerning such a possibility are very conflicting, and indicate a mortality varying from 50 to 100 per cent., as shown by the following figures: Sippel 100 per cent., Bumm 83 per cent., Seitz 66  $\frac{2}{3}$  per cent., Herff 60 to 70 per cent., Seegert 61 per cent., and Opitz 50 per cent. The last, named observer calculated that the mortality was 55  $\frac{2}{10}$  per cent. in 339 clinical cases treated by Bumm, Cursch-

mann, Fischer, and himself, although the majority of writers believe that his estimate is too favorable, and consider that the average mortality in conservatively treated cases exceeds 66  $\frac{2}{3}$  per cent. This being the case, it is apparent that any procedure is worthy of respectful consideration which offers the slightest hope of increasing the probability of a larger proportion of cures.

At this time I desire to call your attention to the possibility of coping with puerperal pyemia by the excision or ligation of the thrombosed pelvic veins; and, after reporting my own experience in five cases, I shall review the literature upon the subject with the view of ascertaining what has already been done and of forecasting what may be accomplished in the future.

*Historical Notes.*—Freund, in 1898, stated that in certain cases of infection occurring from the placental site, von Recklinghausen found the entire generative tract normal, with the exception of thrombosis of one or both spermatic veins, and suggested that cure might be effected by their excision. He reported two such operations with fatal termination, but his suggestion passed unnoticed for several years, as it was buried in a 61-page article "upon the methods and indications for the total extirpation of the uterus," and did not become generally known until Trendelenburg and Bumm had reported their first operations in 1902.

Somewhat similar suggestions were made by Sippel in 1894 and Lusk in 1896, but they advocated that both the uterus and veins be excised simultaneously. J. Christian Simpson, in an article upon "Intravascular Coagulation" appearing in the Edinburgh hospital reports for 1898, also casually remarked that "during the earlier stage in some cases of sepsis after labor or abortion it would be practical to explore the iliac veins and apply a ligature, as has been done so successfully in the cases of septic thrombosis of the internal jugular vein."

The actual history of the operation, however, began in 1902, when Trendelenburg and Bumm, quite independently of one another, published their first articles upon the subject. The former stated that there was no inherent reason why the ligation of thrombosed pelvic veins in puerperal pyemia should not give results more or less analogous to those following ligation of the internal jugular vein in cases of sinus thrombosis, as first practised by Zaufal. After referring to the statistics collected by Viereck, which showed eighty-nine cures following 108 operations as compared with forty-seven deaths in forty-nine unoperated



cases reported by Jansen, he stated that the spermatic and hypogastric veins could be exposed extraperitoneally by a lumbar incision and then be excised or ligated as appeared advisable. He reported that he had operated upon five cases: four, which were examples of acute pyemia, ended fatally; while a successful result was obtained in a chronic case. In this instance he opened a broad ligament abscess on the twentieth day after an abortion, ligated the right hypogastric vein on the forty-third day, and the right spermatic vein on the seventy-third day. In view of these results he held that little could be expected of the operation in acute pyemia, but considered that it should give excellent results in the chronic forms, provided it were performed as soon as a positive diagnosis was made. This he held was assured whenever an ill-defined worm-like mass could be palpated at the outer end of either broad ligament in a patient who had had a second chill.

Almost simultaneously Bumm reported that he had excised the thrombosed spermatic vein in three patients after laparotomy. None of these were uncomplicated cases and all ended fatally, but he nevertheless held that the operation was justified as a last resort unless the pelvic connective tissue was infiltrated or the veins of the leg involved.

Since then the operation has been quite extensively employed, and I have been able to find in the literature reports of fifteen cases in which the veins were attacked extraperitoneally and of thirty-six cases in which they were ligated or excised after laparotomy, not including my own five cases. Most of the operations have been reported by German writers, although three were performed in England by Michels, Cuff and Bland-Sutton, and two in Australia by Lendon and Moore. As far as I have been able to learn none have been reported from this country or France, although Moréstin, Lejars, and Faix indorsed the procedure theoretically at the 1906 meeting of the French Surgical Congress.

*Statistical Results.*—I shall here give a very brief abstract of my five cases and refer those interested in particulars to the detailed histories at the end of the article.

CASE I.—Bailey. February, 1903. Excision of right appendages and thrombosed right spermatic vein on the fifth day after a premature labor at the seventh month. Abdominal drainage. Some temperature for seventeen days. Perfect cure.

CASE II.—Chilcoat. July, 1907. Ligation of left ovarian vein fourteen days after a criminal abortion at the second month. Repeated chills, temperature  $106^{\circ} \frac{2}{5}$  before operation. Im-

mediate disappearance of chills and temperature afterward. Ideal convalescence.

CASE III.—Smithman. September, 1907. Infected abortion. Uterus emptied tenth day. Typical hectic course. On twenty-first day excision of thrombosed right spermatic vein and abscess of right ovary; opening and drainage of several subperitoneal abscesses. Operation of no avail. Death twenty-two days later from pyemia with generalized metastatic abscesses.

CASE IV.—Ballard. February, 1908. Infected abortion. Uterus emptied seventh day. Typical hectic temperature and chills. On fourteenth day ligation of thrombosed right spermatic and median iliac veins. No further chills after operation, but temperature persisted. Rapid development of a broad-ligament abscess in the right side which was opened extraperitoneally on the eighth day after laparotomy. Gradual recovery.

CASE V.—Twilley. September, 1908. Admitted eight days after an infected abortion, with hectic temperature, chills, and signs of beginning pulmonary involvement. Immediate operation. Ligation of thrombosed left spermatic vein and excision of inflamed left tube. No further chills after operation. Double pneumonia. Critical fall of temperature on eleventh day. Rapid recovery afterward.

In every instance, except in Case II, the uterine lochia were examined bacteriologically and showed the presence of streptococci in pure culture. They were also demonstrated in the thrombosed vessels whenever excised tissues were available for examination. Cultures were not made in Case II, as the patient was sent to the hospital for immediate operation, after being seen in consultation, and, as the thrombosed vessel was merely ligated, no tissues were available for examination.

Upon analyzing my cases, it is seen that four recovered and one died, a gross mortality of 20 per cent., which is in marked contrast with the average of 66 per cent. under expectant treatment. In Case II, the process was apparently jugulated by the operation, as the temperature did not rise above 100° during convalescence. In Case I rapid and satisfactory cure followed the operation, while in Case IV convalescence was complicated by the development of a broad ligament abscess. Case V was probably an example of acute pyemia and pulmonary complications were present at the time of operation, which later developed into double pneumonia. In this instance ligation of the thrombosed spermatic vein apparently checked the pyemic process and enabled the patient to cope successfully with the pulmonary complication, which was clearly metastatic in character. In the fatal Case III operation was delayed too long, as the patient

was kept under observation for eleven days after admission to the hospital with pronounced hectic temperature and daily chills. When the operation was finally performed the infection had passed beyond the thrombosed vein; there was an ovarian abscess, signs of localized peritonitis and several subperitoneal abscesses. Naturally, interference was useless and death followed twenty-two days later from general pyemia; the autopsy showing generalized metastatic abscesses, cava thrombosis, and pelvic peritonitis.

From my personal experience I have gained the impression that the operation is valuable and is destined to save many lives if promptly performed. In one of my cases it jugulated the pyemic process, and in the other three favorable cases appeared to shorten materially the course of the disease, so that the patients were probably spared weeks or months of prolonged illness, even though they might have recovered spontaneously.

A. *Extraperitoneal Method.*—Turning to the experience of others as laid down in the literature, it is found that one or more vessels have been ligated by the extraperitoneal method in fifteen instances (see Table A). Lenhartz has reported eight operations, seven of which were performed by KümmeI, Trendelenburg five, and Michels and Bland-Sutton one operation each.

These show a gross mortality of 80 per cent., but upon deducting the five acute cases operated upon by Trendelenburg and Lenhartz as well as the one case of Bland-Sutton which was complicated by peritonitis, it is seen that there were three recoveries in nine cases of chronic pyemia, a mortality of  $66 \frac{2}{3}$  per cent. which is identical with that following expectant treatment. Such figures, however, do not give a correct idea as to what may be accomplished by the operation, as they include several cases in which the thrombotic process had extended too far to be susceptible of cure, as well as others in which other vessels than those thrombosed had been ligated by mistake, so that the operation could exert no influence upon the course of the disease. Excluding such cases from consideration, only five remain which appeared to offer favorable prospects for a successful outcome, and of these two died, a corrected mortality of 40 per cent.

As trustworthy conclusions cannot be drawn from so small a material, it is impossible at the present time to express a definite opinion concerning the curative value of the extraperitoneal operation. At the same time, I have not been favorably im-



pressed by the study of the reported cases, and the fact that so few operators have employed it seems to indicate that they share my feelings.

One of its great disadvantages is the difficulty in determining which vessels are thrombosed, and the consequent necessity of making an incision in both flanks if one wishes to be certain of ligating all vessels implicated. Moreover, considerable difficulty may be experienced in differentiating the various vessels, Lenz having reported that in one instance even so experienced an operator as Kümmer had ligated the pudic for the hypogastric vein, and in another instance made the same mistake, as well as having ligated some other small vein for the spermatic; while in a third case the ureter was tied off. On the other hand, after laparotomy the vessels are readily isolated, so that it is possible to determine with reasonable certainty which are involved in the thrombotic process and need ligation; while at the same time an opportunity is afforded for the thorough inspection of the pelvic organs. Moreover, only a single incision is necessary, and the operation can be completed much more rapidly when it is necessary to ligate vessels on both sides of the pelvis. Indeed, it appears to me that the only plausible argument in favor of the extraperitoneal method is the possibility which it offers of avoiding peritoneal infection, when it becomes necessary to excise the offending vessels; but even this danger seems to be more apparent than real, as peritonitis occurred only twice in a comparatively large series of transperitoneal operations, while it was noted in one instance following the extraperitoneal technic. Even Trendelenburg in his last article recognizes the shortcomings of the latter, and states that only the future can determine which will prove to be the method of choice.

A. EXTRA-PERITONEAL OPERATIONS.

Authors	Date of report	Age	Pregnancy	First chill	Number of chills	Highest temperature	General condition	Day of operation	Anatomical conditions at operation	Operation	Autopsy	Recovered	Died
1 Trendelenburg	1902	35	abort.	?	daily	high	poor	43d	Thrombosis R. spermatic and hypogastric	20 d. opened broad lig. abscess; 43 d. ligation R. hypogastric; 73 d. ligation R. spermatic		+	-
2-5 Trendelenburg	1902		Four acute cases						No details	All died after operation		-	+
6 Michels	1903	28	abort.	4d	daily	40.8	serious	23d	Thrombosis I. spermatic	Excision I. spermatic		+	-
7 Lenhartz	1906	23	abort.	2d	many	41	bad	26d	Thrombosis I. spermatic	Excision I. spermatic	Peritonitis. L. ureter tied off	-	+
8 Lenhartz	1906	33	abort.	5d	many	high	bad	55d	Thrombosis R. hypogastric	Ligation R. hypogastric, 10 d. later excision R. spermatic		+	-
9 Lenhartz	1906	24	term	10d	47	high	bad	42d	R. sited vessels imbedded in-inflammatory tissue	Ligation both vessels	Cava thrombosis. Pudic vein ligated for hypogastric	-	+
10 Lenhartz	1906	29	abort.	3d	many	high	bad	63d	Thrombosis L. spermatic and internal iliac	Ligation both vessels	Lung abscesses. Cava thrombosis, also L. femoral vein	-	+
11 Lenhartz	1906	20	term	11d	several	41.4	bad	12d	Thrombosis L. com. iliac spermatic and saphena	Ligation all three vessels	No peritonitis. Thrombosis in spermatic above ligature	-	+
12 Lenhartz	1906	34	abort.	2d	many	?	bad	28d	Thrombosis L. com. iliac and spermatic	Ligation both vessels	Cava thrombosis. Infarct R. lung. Abscess liver	-	+
13 Lenhartz	1906	29	term	?	?	?	bad	8d	Thrombosis R. hypogastric and spermatic	Ligation both vessels	Pudic ligated for hypogastric, small vein for spermatic, original vessels thrombosed	-	+
14 Lenhartz	1906	43	abort.	6d	12	?	bad	12d	Thrombosis L. spermatic and hypogastric	Ligation both vessels	Lung abscess. No thrombosis above ligature.	-	+
15 Bland-Sutton	1909	35	abort.	12d	?	?	poor	?	Thrombosis; lost woman; peritonitis	Excision R. ligation to spermatic iliac vein. Laparotomy and drainage	Eighth day. Thrombosis R. Common and internal. Pulmonary embolism	-	+

SUMMARY:

Total, Fifteen cases, twelve deaths, 80 per cent. mortality.

One spermatic vein excised, two cases, Nos. 6 and 7. One death from peritonitis. Spermatic and hypogastric vein ligated—Eight cases, Nos. 1, 8, 9, 10, 11, 12, 13, 14, six deaths. Acute pyemia. No details, all fatal. Four cases, Nos. 2-5. Autopsy showed: pudic vein ligated instead of hypogastric, Case 9. Cava thrombosis, Cases 10 and 12. Purulent thrombosis above ligature, Case 11. Pudic vein ligated for hypogastric, and another small vein for spermatic, Case 13. Acute pyemia, operation twelfth day, Case 14. Thrombosis in common and internal iliac, Case 15. Deducting two cases for cava thrombosis, two for ligation of wrong vessels, and five for acute pyemia, one finds that three favorable cases were operated upon with three recoveries, 40 per cent. corrected mortality.

B. *Intraperitoneal Method.* Including the two fatal cases reported by Freund in 1898, I have been able to collect from the literature forty-one cases, including five of my own, in which one or more pelvic veins have been ligated or excised after laparotomy with a gross mortality of 43.9 per cent. (see tables B to I).

Summary of Transperitoneal Operations	Total operations	Total deaths	Gross mortality	Favorable cases	Death in same	Corrected mortality
One spermatic excised . . . . .	10	7	70%	3	0	0%
One spermatic ligated. . . . .	7	1	14	7	1	14
Ligation or excision both spermatics. . . . .	5	3	60	2	0	0
Ligation or excision one spermatic and one hypogastric. . . . .	4	1	25	4	1	25
Ligation or excision both spermatics and one hypogastric. . . . .	2	1	50	2	1	50
Ligation or excision both spermatics and hypogastrics. . . . .	8	2	25	8	2	25
Ligation or excision one hypogastric. . . . .	2	1	50	2	1	50
No details. . . . .	3	2	66.6	0	0	0
Total. . . . .	41	18	43.9	28	6	21.4%

Study of the tabular list of cases shows that it includes several examples of acute pyemia; and upon deducting them, as well as a series of cases in which the ligature was applied below the central end of the thrombus or in which the vessel could not be ligated in healthy tissue or in which some other than the thrombosed vessel was erroneously ligated, twenty-eight cases remain which offer a fair test of the capabilities of the operation. Six of these ended fatally, a mortality of 21.4 per cent. following the intraperitoneal operation, and a surprising improvement over the results following expectant treatment.

The contrast becomes even more striking if one considers the several groups of cases laid down in the above summary. Thus, for example, there was only a single death in the twelve favorable cases in which one or both spermatic veins were ligated or excised. This represents a mortality of only 8 1/2 per cent., as contrasted with 31 per cent. in the sixteen favorable cases in which one or both hypogastric veins were ligated along with the spermatic.

# TRANSPERITONEAL OPERATIONS.

## B. ONE SPERMATIC VEIN EXCISED AFTER LAPAROTOMY.

Authors	Date of report	Age	Pregnancy	First chill	Number of chills	Highest temperature	General condition	Day of operation	Anatomical conditions at operation	Operation	Autopsy	Recovered	Died
1 Freund.....	1898	?	?	?	?	?	?	?	Spermatic and cava thrombosed	Excision of spermatic.....	General metastases	-	+
2 Freund .....	1898	?	?	?	?	?	?	?	All veins involved .....	Excision of spermatic.....	?	-	+
3 Bumm.....	1902	?	?	?	?	?	?	?	Thrombosed spermatic Retro-peritoneal phlegmon	Excision of spermatic .....	?	-	-
4 Bumm.....	1902	?	?	?	?	?	?	?	Thrombosis L. spermatic .....	Excision of spermatic.....	Thrombosis above excision	-	+
5 Bumm.....	1902	..	?	?	?	?	?	?	Thrombosed spermatic, broad ligament involved	Complete excision not possible .	?	-	-
6 Moore .....	1907	26	abort.	3d	daily	106	bad	24d	Thrombosis R. spermatic broad ligament abscess	Excision R. spermatic, Clot above ligation. Removal R. tube and ovary	Second operation 4 days later, R. cava thrombosis	-	+
7 Moore .....	1907	29	abort.	5d	daily	107	bad	22d	Thrombosis R. spermatic.....	Excision R. spermatic, Removal R. tube and ovary	.....	+	-
8 Leopold.....	1908	25	term	3od	many	40.4	bad	4od	Double femoral phlebitis, thrombosis R. spermatic	Excision R. spermatic, Removal R. tube and ovary	.....	+	-
9 Williams.....	1909	19	7 mos.	2d	1	102	fair	5d	Thrombosis R. spermatic, Indurated broad ligament	Excision R. Spermatic, Removal R. tube and ovary	.....	+	-
10 Williams.....	1909	25	abort.	6d	daily	106	poor	2od	Thrombosed R. spermatic, Salpingitis. Broad ligament abscess	Excision R. spermatic, Removal R. tube. Drainage of abscess	Death 17 days later. Abscess of lungs. General pyemia	-	+

Total, ten cases, three recoveries, 70 per cent. gross mortality.

### SUMMARY:

Cava thrombosis, Cases 1 and 6; thrombi above excision, Case 4; all veins involved Case, 2; broad ligament phlegmon, Cases, 3, 5, 10. Deducting these seven cases, three favorable cases are left with three cures = 0 per cent. corrected mortality.



C. LIGATION ONE SPERMATIC VEIN AFTER LAPAROTOMY.

Authors	Date of report	Age	Pregnancy	First chill	Number of chills	Highest temperature	General condition	Day of operation	Anatomical conditions at operation	Operation	Autopsy	Recovered	Died
11 Cuff.....	1906	30 term	2d	many	105	poor	27d	Thrombosis R. spermatic. Indurated broad ligament	Ligation R. spermatic	.....	.....	+	-
12 Lendon.....	1907	24 term	2d	frequ.	?	bad	7d	Thrombosis R. spermatic.....	Ligation R. spermatic	.....	.....	+	-
13 Seitz.....	1907	23 term	4d	many	41	poor	14d	Acute pyemia R. ovary size of egg	Ligation R. spermatic. Ovary not removed	.....	.....	+	-
14 Berkofsky.....	1908	30 term	3d	daily	?	fair	8d	Thrombosis L. spermatic cyst L. ovary	Ligation R. spermatic. Removal L. ovary.....	.....	.....	+	-
15 Berkofsky.....	1908	? about	?	?	?	?	?	Abscess bt. coils of intestines. Thrombosis R. spermatic	Ligation R. spermatic.....	Peritonitis	.....	-	+
16 Williams.....	1909	abort.		daily	106	fair		Thrombosis R. spermatic....	Ligation R. spermatic.....	.....	.....	+	-
17 Williams.....	1909	27 abort.	2d	daily	104	poor		Thrombosis L. spermatic. Pulmonary involvement	Ligation L. spermatic.....	.....	.....	+	-

Total, seven cases, six cures, 14 per cent. mortality.

SUMMARY:

Seventeen cases excision or ligation of one spermatic, nine cures=47 per cent. gross mortality. Deducting seven unfavorable cases (see B), leaves ten favorable cases with one death=10 per cent. corrected mortality. Including ten cases from table B.

D. LIGATION OR EXCISION BOTH SPERMATIC VEINS AFTER LAPAROTOMY.

Authors	Date of report	Age	Pregnancy	First chill	Number of chills	Highest temperature	General condition	Day of operation	Anatomical conditions at operation	Operation	Autopsy	Recovered	Died
18 Opitz.....	1905	? abort.	57d	freqt.	41.5	serious	66d.	Thrombosis both spermatics Hypogastrics normal	Ligation both spermatics.....	Death day of operation. On L. side thrombus extended above ligature into renal vein		-	+
19 Berkofsky.....	1908	29 abort.	3d	daily	40	serious	31d		Ligation both spermatics.....			+	-
20 Berkofsky.....	1908	22 abort.	3d	daily	39	serious	28d	Pulmonary symptoms.....	Ligation both spermatics.....			+	-
21 Berkofsky.....	1908	? term	? ?	? ?	? ?	? ?	? ?	Acute pyemia.....	Ligation both spermatics in inflammatory tissue	Thrombosis R. femoral iliac and hypogastric veins		-	+
22 Berkofsky.....	1908	? term	? ?	? ?	? ?	? ?	? ?	Acute septic pyemia.....	Ligation both spermatics.....	Spermatics free, both hypogastrics thrombosed		-	+

Total, five cases, two recoveries, 60 per cent. gross mortality.

SUMMARY:

Case 18, thrombosis above ligature; Case 21, thrombosis in other vessels; Case 22, spermatics free, but hypogastrics thrombosed. Deducting these leaves two favorable cases with no mortality.

E. LIGATION OR EXCISION OF ONE SPERMATIC AND HYPOGASTRIC VEIN BY LAPAROTOMY.

23 Bumm.....	1905	? term	8d	daily	?	poor	48d	Thrombosis L. side, endocarditis (?)	Ligation R. spermatic and hypogastric	Cava thrombosed. Abscess of lung		-	+
24 Bumm.....	1905	33 abort.	6d	daily	40.5	good	18d	Thrombosis R. side.....	Ligation R. spermatic and hypogastric			+	-
25 Friedemann.....	1908	27 abort.	3d	daily	40.8	good	21d	Thrombosis L. side.....	Ligation L. spermatic and hypogastric			+	-
26 Williams.....	1909	18 abort.	8d	daily	103.7	fair	14d	Thrombosis R. side.....	Ligation R.-sided vessels. Later opened broad lig. abscesses			+	-

Total, four cases, one death = 25 per cent. mortality.

F. LIGATION BOTH SPERMATICS AND ONE HYPOGASTRIC BY LAPAROTOMY.

Authors	Date of report	Age	Pregnancy	First chill	Number of chills	Highest temperature	General condition	Day of operation	Anatomical conditions at operation	Operation	Autopsy	Recovered	Died
27 Friedemann....	1906	27	abort.	6d	daily	40.8	serious	36d	14th day pulmonary embolism later abscess	Ligation both spermatics and R. hypogastric		+	-
28 Fromme.....	1907	34	abort.	9d	daily	41	serious	38d	R. parametrial abscess opened 25th day	Ligation both spermatics and R. hypogastric	Pulmonary abscess. Pleurisy. Cava thrombosis. Nephritis 3 weeks p. o.	-	+

Total, two cases, one death = 50 per cent. mortality.

G. LIGATION OR EXCISION OF BOTH SPERMATIC AND HYPOGASTRIC VEINS BY LAPAROTOMY.

29 Bumm.....	1905	20	term	2d	daily	40	fair	64d	Peritonitis. Thrombosed vessels R. side	Drainage for peritonitis 4th day. Ligation both spermatics and hypogastric		+	-
30 Bumm.....	1905	22	term	27d	daily	41.5	fair	34d		Ligation both spermatics and hypogastrics. Marked swelling of genitalia		+	-
31 Haeckel.....	1905	42	hydrotid mole	24d	daily	39.6	poor	44d	Thrombosed veins	Ligation both spermatics and hypogastrics	Prompt recovery.	+	-
32 Haeckel.....	1905	31	term	5d	daily	?	serious	?	Acute pyemia, pneumonia	Ligation both spermatics and hypogastrics. Later common iliac	None	-	+
33 Fromme.....	1907	28	term	3d	freqt.	40.8	serious	12d	Acute pyemia	Double-sided ligation		+	-
34 Berkofsky....	1908	?	abort.					?	Acute septic pyemia	Double-sided ligation	Not stated	-	+
35 Bardeleben...	1908	22	term	15d	many	41	serious	70d		Double-sided ligation		+	-
36 Bardeleben ...	1908	31	abort.	13d	54	42	serious	30d	Thrombosis L. side	Ligation both spermatics and both hypogastric arteries and veins		+	-

Total, eight cases, two deaths, 25 per cent. mortality. Deducting acute Cases 32 and 33, no mortality.

H. LIGATION ONE HYPOGASTRIC VEIN BY LAPAROTOMY.

Authors	Date of report	Age	Pregnancy	First chill	Number of chills	Highest temperature	General condition	Day of operation	Anatomical conditions at operation	Operation	Autopsy	Recovered	Died
37 Bumm	1905	27	term	17d	repeated	40	poor	56d		Ligation L. hypogastric and	Peritonitis, Cava thrombosis Infarcts in various organs. Pneumonia.	-	+
38 Latzo	1097								Ligated hypogastric artery and vein on one side. Removed thrombosed vessels through vagina. Died 5 weeks later from hemorrhage.	Hemorrhage from central of hypogastric artery		-	+

Total, two cases, two deaths, 100 per cent. mortality.

I. NO DETAILS.

39 Latzo	1907											-	+
40 Latzo	1907											-	+
41 Latzo	1907											-	+

Total, three cases, two deaths, 66 2/3 per cent. mortality.



At first glance, such results would seem to invalidate the contention of Bumm and Bardeleben that the ideal procedure consists in the simultaneous ligation of both spermatic and both hypogastric veins, in the hope of rendering innocuous small thrombi which are not accessible to palpation, but which might continue to throw off infected emboli after the palpably thrombosed vessels had been ligated. To my mind, however, such a conclusion is not justified for several reasons. In the first place it would seem in the more benign cases that the thrombotic process is frequently limited to a single spermatic vein, whose prompt ligation would effectually check the production of pyemic symptoms, and thus offer a most favorable prognosis. On the other hand, when one or both hypogastrics are likewise involved, the process is certainly more extensive and probably due to bacteria of greater virulence, so that the likelihood of being able to apply the ligature above the central ends of all the thrombi is materially diminished. Moreover, the observations of Konatski show that in a considerable proportion of cases the venous trunk from the lower portion of the pelvic organs empties into the external iliac as a separate vessel, the median iliac vein, instead of fusing with the other vessels from the rectal and gluteal regions to form the hypogastric vein. Should such a condition be overlooked, it might readily happen that a ligature applied to the supposed hypogastric would cut off only the return blood from the rectal and gluteal regions, while the thrombosed median iliac vein would remain free to cast off infected emboli into the general circulation.

It is difficult to arrive at accurate conclusions as to the relative frequency with which the various veins are involved, as the statements of the various writers are quite contradictory. They are, moreover, based upon autopsy records which give information only as the terminal findings, and by no means represent the conditions which would have been encountered had an early operation been performed. Thus, Freund and Seegert state that the process is usually confined to one or both spermatics, while Trendelenburg holds that it is limited to the vessels of one side of the pelvis in only about one-third of the cases. On the other hand Opitz, Grossmann, and Lenhartz found a single spermatic vein involved in only 9.11 and 13 per cent. of their autopsies, respectively.

As far as I can gather from my own experience and the reports in the literature, the operation is quite easy in suitable cases, and

is well borne by the patient. The danger of peritonitis has been greatly exaggerated as it was noted only in three cases reported by Berkofsky, Bumm, and myself. In the first instance it was due to an abscess between coils of intestines, and in my case was merely an extension from the subperitoneal abscesses, and clearly not an immediate consequence of the operation, as death did not occur until twenty-two days afterward.

*Indications for Operation.*—The more or less favorable results which I have shown follow the transperitoneal method of operating clearly indicate the justifiability of the procedure, as well as the necessity for its performance at the earliest possible moment; as only by so doing can one expect to find the process limited to the distal portion of a single vessel, and each day's delay increases the probability of its extension and diminishes the chance of being able to contro' it.

Unfortunately, the diagnosis is not always easily made and it sometimes happens by the time it has been established that the process has extended beyond all hope of surgical aid. Generally speaking, it may be said that the occurrence of frequent chills and a hectic temperature renders the diagnosis fairly probable, which becomes assured whenever one can palpate the thrombosed vessels as a small, irregular, worm-like mass high up in the outer portion of either broad ligament, as was done by Lenhartz in thirty-one out of thirty-nine pyemic cases. In other instances, however, a positive diagnosis cannot be made, and I have already referred to one of my own patients in whom thrombosis of the vena cava was found at autopsy, and yet during the course of the illness she did not present chills or high temperature.

In view of the difficulty of diagnosis and the necessity for prompt interference, Trendelenburg proposed operating after the occurrence of a second chill. His suggestion, however, has not been favorably received, and is generally regarded as too radical. More particularly, as Herff has pointed out that each chill may be the last one, while Seegert has shown that spontaneous recovery may occur after as many as seventy.

I believe that the operation should be undertaken whenever a positive diagnosis can be made, while in those cases in which thrombosed vessels cannot be palpated through the vagina, I consider that the determination to interfere should be governed entirely by the general condition of the patient, and that the abdomen should be opened if she is seriously ill and the clinical

symptoms show no signs of improvement, provided, of course, that peritonitis or a broad-ligament abscess has not developed.

All observers agree that the prospects of cure are far greater in the chronic than in the acute form of pyemia. Consequently when the chills and hectic fever do not appear until ten days or two weeks after the abortion or labor, the prognosis will be much more favorable than if the symptoms appear earlier. Bardeleben's experimental work upon the production of streptococcic thrombosis affords a satisfactory explanation for this difference, as he has clearly shown when virulent bacteria are used that there is comparatively little local involvement of the vessels and that even the prompt amputation of the affected part will not prevent the death of the animal from a general infection; whereas when the streptococci are of lesser virulence, the thrombotic process is much more pronounced and the bacteria show little if any tendency to invade the vessel walls. In this event symptoms are due to the breaking down of the thrombi and the entrance of infected emboli into the circulation, so that the application of a ligature beyond the thrombus tends to check the further spread of the process, while the bacteria gradually die out in the localized area.

If the patient is not seen until after the development of multiple metastatic abscesses, operation will probably prove unavailing. On the other hand, the presence of localized pleurisy due to isolated pulmonary infarction or even of signs of beginning septic pneumonia, do not necessarily contraindicate it; and in my Case V the beginning pulmonary involvement afforded the indication immediately after the admission of the patient to the hospital. The appearance of acute endocarditis or of definite pulmonary abscess or pneumonia usually indicates that the patient is suffering from general pyemia and that the thrombotic process has become so extensive as to offer but little hope of alleviation by operative measures, although even in such cases there is always a remote possibility of spontaneous cure.

*Technic.*—As the general consensus of opinion seems to indicate the great superiority of the transperitoneal over the extra-peritoneal method of operating, I shall consider only the technic of the latter.

After opening the abdomen by a moderately large incision, with the patient in the Trendelenburg position, the intestines should be pushed out of sight and protected by suitable compresses, thereby affording a satisfactory view of the pelvic



contents. The tube and ovaries should be carefully examined and the outer ends of the broad ligament carefully palpated, after which the infundibulopelvic ligaments should be followed to their pelvic insertion and the course of the spermatic veins mapped out above the point. The lateral and posterior portion of the pelvic wall should then be carefully palpated in order to determine whether the hypogastrics are likewise involved. If the slightest trace of hardening be detected along the course of any of the vessels, the existence of thrombosis should be assumed and preparations made for ligating or excising the affected vessel or vessels. If only one spermatic is involved, the peritoneum covering it should be incised and the vessel carefully palpated in order to determine the location of the central end of the thrombus, and a single chromicized catgut ligature applied well above it. Its point of application will depend upon the extent of the process, so that in some instances the ligature may be applied just above the pelvic brim, while in others it may have to be placed at its central end, just before it opens into the vena cava or renal vein, according as the right or left side is implicated.

If the process is clearly limited to one spermatic, its ligation will complete the essential part of the operation, which is concluded by uniting the peritoneal incision over the vein by a continuous suture and then closing the abdominal wound in the usual manner. If, however, there is any suspicion that both spermatics are implicated, sutures should be applied on either side.

From my own experience, as well as that of others as recorded in the literature, ligation is usually all that is necessary, and excision is demanded only in exceptional cases in which marked periphlebitis is present or in which the thrombosed vein presents areas of softening which appear likely to lead to perforation within the course of a few days. In such cases two ligatures should be applied, one well above the central end of the thrombus and the other over the infundibulopelvic ligament, and the vessel severed between them by means of a thermocautery. Ordinarily, the removal of the tube and ovary on the affected side is not necessary, and should be resorted to only in the presence of a definite lesion.

If ligation of one or both spermatics is all that is indicated and the process is not complicated by local inflammatory lesions, the prognosis is very favorable, and the patient has a good prospect of rapid and permanent cure. Indeed, Berkofsky believes



that in any event this should be the extent of the operation, as he holds if the process be so extensive as to necessitate ligation of the hypogastric veins as well, that the prospects of cure are minimal and will actually be reduced by the manipulation incident to the more extensive operation.

If, however, one or both hypogastrics appear to be involved or if one accepts the dictum of Bumm and Bardeleben that all four vessels should be ligated as a matter of principle in every case, steps should be taken to expose and ligate these vessels before closing the peritoneal incision over the spermatic vein. For this purpose, after extending the lower end of the incision somewhat backward and downward if necessary, the index-fingers of either hand should be inserted into its lower end and passed down into the connective tissue along the pelvic brim, and upon drawing them apart, so that one finger approaches the infundibulopelvic ligament and the other the sacroiliac joint, the iliac vessels come into view. These manipulations should be continued until the bifurcation of the common iliac become apparent, so that the external and internal iliac arteries can be clearly differentiated. The hypogastric vein on either side will then be found lying below and somewhat to the right of the internal iliac artery, so that the latter must be displaced before the former becomes accessible. This is accomplished by drawing the artery to the left by means of the fingers or by a suitable retractor, so that if it is desired to expose the right hypogastric, the right internal iliac artery should be retracted toward the midline, while on the left side the artery should be retracted laterally. When the hypogastric vein has been properly exposed, the ligature should be applied by means of a blunt aneurysm needle as close as possible to its point of junction with the external iliac vein, and the peritoneal incision closed by a continuous suture.

These manipulations are less difficult in the living woman than upon the cadaver, as the pulsation of the artery and the induration of the affected vein render the differentiation of the vessels quite easy. The ligature should be applied by means of an aneurysm needle, or a specially prepared blunt needle, as a sharp-pointed one increases the danger of puncturing a vessel, and thus leading to the unpleasant complication of hemorrhage or the escape of infected material.

Great stress should be laid upon securing the best possible exposure before applying the ligatures, more particularly in view of the observations of Konatski upon the occurrence of frequent

aberrations in the course of the venous trunks of the pelvis. Normally, the blood from the base of the bladder and lower part of the uterus is collected by a large vein, which fusing with another vessel containing blood from the gluteal and rectal regions forms the hypogastric or internal iliac vein. Konatski, however, has shown that this occurs in only about 70 per cent. of the cases, while in the other 30 per cent. the two vessels open separately into the external iliac vein. Under such circumstances he designates the large vein, containing blood from the bladder and uterus, as the median iliac, and the smaller one, returning blood from the gluteal and rectal regions, as the internal iliac vein.

It therefore becomes apparent that the possibility of such an abnormality should always be borne in mind, as with imperfect exposure it may readily happen that the internal iliac might be ligated for the hypogastric vein and the median iliac be overlooked, when it would be free to pour its infectious contents into the external iliac and thus render illusory the effect of the operation.

One or both spermatic veins may be ligated with impunity, and the question naturally arises as to what might happen if both hypogastrics were ligated as well. *A priori*, it would seem unlikely that sufficient collateral circulation could be established to maintain the nutrition of the pelvic organs, but the observations of Bumm, Bardeleben, Haeckel, Fromme, and Berkofsky show that such fears are groundless and that a fairly satisfactory collateral circulation is promptly established. In none of the reported cases did gangrene occur, although the external genitalia became markedly swollen and edematous for a few days. This usually subsided spontaneously, although in one of Bumm's patients it was followed by a pronounced varix formation; while in another the interference with circulation gave rise to marked passive congestion of the uterus which manifested itself by a constant serous discharge from that organ, which had persisted eighteen months after the operation.

Indeed, even more radical interference may be had without serious consequences, as was demonstrated in one of Haeckel's cases in which the common iliac vein was ligated. This did not cause gangrene of the leg as might have been expected, although such an issue might occur in other cases. In order to guard against it, he recommends that the opposite hypogastric should not be ligated, in case so radical an interference should appear indicated on one side. Trendelenburg even went a step further,

and has reported that he ligated the lower end of the vena cava in two instances and that the patients lived for six and thirteen days, respectively, after the operation without untoward effects. Such a result can only be explained by supposing that the antecedent thrombosis had occurred sufficiently gradually to permit the establishment of a satisfactory collateral circulation, as it is inconceivable that so radical an interference with the return of blood from the extremities and pelvic organs could be withstood under ordinary conditions. The correctness of such an explanation is borne out by the fact that in several instances I have seen women come to autopsy with thrombosis of the lower portion of the vena cava, and yet during life present little if any signs of impaired circulation.

J. W. Taylor, F. E. Taylor, Latzo, Sinclair, and others have proposed that the thrombotic process be attacked through the vagina, and have reported good results from the operation. While it is conceivable that such a procedure may be applicable when the thrombosis is limited to the vessels of the pampiniform plexus, and associated with periphlebitic inflammation or even with broad-ligament phlêgmons, it is apparent that it could not be utilized in the class of cases under discussion in which the spermatic or hypogastric veins are involved. For this reason, it seems to me that it is inadvisable to consider such proposals at this time, as I hold that they demonstrate that their authors fail to appreciate the significance of the pyemic process, and I consider that their discussion would only serve to obscure the question at issue.

#### HISTORY OF CASES.

CASE I.—Mrs. J. B. B. Consultation with Dr. C. W. Larned, February 9, 1903. The nineteen-year-old primipara was delivered spontaneously of a seven to eight months' fetus on February 5, 1903. For three days previously she had complained of pain in the right side and slight fever. This continued after delivery and on the following day Dr. Larned palpated a small mass in the appendix region, which at first suggested appendicitis. It grew gradually larger and the patient suffered from paroxysmal pains and occasional chills; the temperature varied between 100° and 102° and the pulse between 100 and 120. The lochia were normal and the bowels readily moved by Rochelle salts.

When I saw her at 5 P. M., February 9, the temperature was 101° and pulse 112. The fundus of the uterus was felt two fingers above the symphysis and extending from its upper right margin was a distinct tumefaction reaching 2 cm. above Poupart's



ligament. This was very sensitive on palpation, but there was no muscle spasm. On vaginal examination the perineum and cervix were found intact, uterus forward and about the size of a fist; on the left side the appendages were normal; on the right side there was a firm hard mass which filled out the broad ligament and was continuous with that felt through the abdomen. A positive diagnosis was not made, although I thought that I had to deal with a hematoma or a beginning phlegmon of the broad ligament, appendicitis having been practically excluded.

The patient was immediately sent to the hospital so as to be under closer observation. Leukocyte count 19,000. During the night she suffered considerable pain, the temperature rising to  $102.5^{\circ}$  and the pulse to 120. On examination the following morning the mass in the right iliac fossa appeared to be larger, so that it was determined to operate at once.

Upon opening the abdomen at the outer margin of the right rectus muscle the appendix was seen to be normal, but a tumefaction was found extending from the right margin of the uterus to the pelvic wall, while the tubes and ovaries were normal except for some edema and a few fibrinous patches upon their surface. On closer examination it was found that the mass offered a brawny feel to the fingers and lay within the folds of the broad ligament and increased rapidly in size as the pelvic wall was approached. It did not extend quite to the right side of the uterus, but at the pelvic wall it formed a tumor 3 cm. in diameter, which then passed upward and backward out of the pelvis as a firm, hard cord-like structure the size of the thumb, and ended in the spermatic vein about 3 cm. above the pelvic brim.

There was considerable doubt as to the best mode of treatment, but it was finally decided to pack off the infected side carefully and to remove the tube and ovary and as much of the indurated structure as possible, and finally to bring the stump into the lower angle of the wound in order to afford free drainage.

After applying a ligature to the spermatic vein just above the induration, its thrombosed portion was removed together with the tube and ovary and as much of the broad ligament as possible. The area was then packed off thoroughly and a gauze drain brought out through the lower end of the wound, whose upper end was closed with sutures. The cut surface of the broad ligament was tense and edematous and presented many thrombosed vessels.

Immediately following the operation the temperature fell to  $99.5^{\circ}$  and pulse to 104. For the following seventeen days there was a low irregular temperature but a good pulse, which varied between eighty and ninety-six. On the fourth day there was quite a severe chill, but no other signs of pyemia.

Patient was discharged on the thirty-seventh day in good condition, the abdominal wound having healed by granulation.

Microscopic examination of the excised tissue showed that the



ovary and tube were approximately normal. The tissues of the broad ligament were so markedly edematous that its component parts were often widely separated. The larger veins were more or less completely thrombosed and presented signs of inflammation in the adventitia. Appropriately stained specimens showed the presence of large numbers of streptococci in the interior of the thrombi.

CASE II.—Mrs. C. C. Seen in consultation with Dr. W. J. Pillsbury, July 18, 1906. The forty-year-old V-para had previously had a number of self-induced abortions, and on July 5 expelled a two months' fetus and membranes following criminal interference.

When Dr. Pillsbury saw her thirteen days later, he obtained a history of repeated chills, fever, abdominal pain, and a foul-smelling vaginal discharge. The temperature was  $102.4^{\circ}$  and pulse 120. The lower abdomen was tender on palpation, but vaginal examination was negative except for an extremely painful area in the left side posterior to the uterus. Notwithstanding the administration of an intrauterine douche and the usual medicinal measures, she was much worse the following day, when she had a severe chill, and the temperature and pulse rose to  $105^{\circ}$  and 140, respectively.

When I saw her the same evening, the temperature was  $106.3^{\circ}$  and pulse 146. She complained of slight abdominal pain, but appeared to be desperately ill. Examination was negative except for a small, painful area of resistance in the outer portion of the left broad ligament. In view of the history and clinical findings, I diagnosed puerperal pyemia, following thrombosis of the veins of the left broad ligament and recommended her removal to the hospital for immediate operation.

She entered the hospital the same night and was operated upon early the following morning, the fifteenth day after the abortion. Upon opening the abdomen both tubes and ovaries were found to be normal, the uterus was fairly well involuted, and there were no signs of pelvic peritonitis. The left broad ligament was somewhat swollen and indurated, and thickened veins could be palpated in its interior. The induration did not extend quite to the pelvic wall, and the spermatic vessels above the pelvic brim appeared perfectly normal. Accordingly, a double ligature was applied to the extreme outer end of the left infundibulopelvic ligament, and the abdomen closed without further manipulations.

The convalescence was remarkable. The temperature fell to  $100^{\circ}$  within a few hours after the operation and never rose above that point afterward. The chills disappeared completely, and the entire recovery was as uneventful as that usually following a simple abdominal operation.

CASE III.—Obst. No. 3152. Smithman. A twenty-five year old IV-para, was admitted September 9, 1907, with a high temperature following a spontaneous abortion. Her previous labors

had been normal, and on August 30 she had a spontaneous three months' abortion which she attributed to overexertion. The placenta was not expelled and she suffered considerably from pain and hemorrhage until a physician was called in three days later. He attempted to remove the placenta upon several occasions, but not with complete success. She had a chill on the sixth day, after which one or more occurred daily. As her condition was growing steadily worse she was admitted to the hospital and the uterus cleaned out immediately afterward.

Examination before operation showed that the cervix was closed; the uterus the size of an orange and rather boggy in consistency; the appendages on the left side were normal, while an ill-defined mass was felt low down in the right broad ligament. After dilating the cervix with Goodell's instrument, the fingers separated a small amount of placental tissue from the posterior uterine wall, which was readily removed by means of ovum forceps, after which a large intrauterine douche of hot saline solution was given and the patient sent to the isolating ward. A sample of uterine lochia obtained immediately before the operation showed the presence of streptococci in pure culture.

Following the operation the patient continued to have one or more chills a day, the temperature and pulse following a typically hectic course, reaching 106° and 160, respectively, upon several occasions, to become subnormal during the remissions. In view of the pronounced intermissions, the possibility of malaria was suspected, but prolonged and repeated search failed to show the presence of plasmodia. Blood cultures were made upon several occasions, but always with negative results.

When I saw the patient ten days after the uterus had been emptied she complained only of slight tenderness in the right ovarian region and had practically no vaginal discharge. The cervix was slightly lacerated bilaterally; the uterus well involuted with its fundus backward and directed toward the left side of the pelvis. Appendages on the left side were apparently normal. On the right side there was a distinct mass quite high up at the lateral end of the broad ligament. It did not depress the vaginal fornix and could not be mapped out satisfactorily. In view of the history and the clinical findings, pyemia was diagnosed, and it was determined to open the abdomen in the hope of restricting its spread by ligating the thrombosed vessels.

Operation on the twenty-first day after abortion. Examination under anesthesia revealed to the right of the uterus and high up in the pelvis a rounded mass, 5 or 6 cm. in diameter, apparently not adherent. Upon opening the abdomen in the midline a small amount of turbid fluid was found in the pelvic cavity, and a few flocculi of lymph were adherent to the colon. The right tube was markedly enlarged and congested, but its fimbriated end was patent; the ovary was twice the usual size and apparently fluctuant. From the infundibulopelvic ligament a brawny induration 2 to 3 cm. in diameter, corresponding

to the right spermatic vein could be traced upward beyond the promontory of the sacrum.

The right ovary and tube were then excised by means of a wedge-shaped incision in the uterine cornu. On cutting through the mesosalpinx a few drops of pus escaped from the ovarian vessels, as well as from a small opening in the peritoneum anterior to the severed end of the infundibulopelvic ligament. After incising the peritoneum over the indurated mass above the pelvic brim, the spermatic vein was gradually isolated. It was found to be firmly thrombosed, being 1 1/2 cm. in diameter at the pelvic brim and only a few millimeters in diameter 6 cm. higher up where the thrombus ended. After applying a ligature beyond the thrombus, the distal end of the vein was excised.

Following this a considerable quantity of pus welled up from the depths of the wound, and upon investigation was found to come from two cavities the size of an orange which lay beneath the cecum, while a smaller abscess was found at the upper and outer end of the broad ligament. After emptying them, they were packed with iodoform gauze and an attempt made to isolate the infected area from the rest of the abdominal cavity, the ends of the pack being brought out through counter openings in the right flank and the posterior culdesac. The abdominal wall was closed in layers. The right hypogastric vein and the vessels on the left side were apparently not involved.

The patient was very much better for twenty-four hours following the operation and the temperature fell to normal. On the second day, however, she had a chill and a temperature of 103°, after which it pursued a hectic course, varying from normal to 105 1/2°, although chills occurred much less frequently than previously. On the sixth day she complained of cough and some pain in the right side of the chest; definite pneumonia gradually developed in the lower and middle lobes of the right lung, the left remaining clear. Death occurred suddenly on the twenty-second day apparently from pulmonary embolism.

The anatomical diagnosis at autopsy was as follows: Pelvic suppuration following abortion and operation. Thrombosis of pelvic veins and vena cava. General pyemia; suppurating peritonitis. Acute bronchopneumonia with abscess formation; empyema, acute mitral endocarditis; acute pericarditis with effusion. Acute suppurative lymphadenitis (bronchial and mediastinal glands). Focal necroses with suppuration in liver, spleen, kidneys, and adrenals. Acute splenic tumor, cloudy swelling of viscera, chronic diffuse nephritis.

Examination of tissue removed at operation. Fallopian tube: some perisalpingitis, mucosa normal, no signs of inflammation. Ovary: Double usual size. Somewhat more than one-half of its interior occupied by an abscess cavity, filled with grayish-green pus. Typical histological picture. No involvement of ovarian vessels. Bacteriological examination of pus showed



pure culture of streptococci. Sections through the excised vein showed marked periphlebitis, well marked endophlebitis, lumen almost completely occluded by a firm thrombus.

CASE IV.—Obst. No. 3351. Ballard. Colored, age eighteen years, II-para, entered the hospital February 21, 1908, with the following history: Spontaneous labor fifteen months previously; last menstrual period in November, 1907. Was perfectly well until February 14, 1908, when she aborted spontaneously of a fetus 14 cm. in length and passed some placental tissue and blood-clots. Four days later she began to be feverish, and when seen by an out-patient assistant had a temperature of  $101^{\circ}$  and a pulse of 120. She had two chills on the sixth day.

Upon admission on the seventh day the temperature was  $102.4^{\circ}$ , pulse 140. As there was considerable foul-smelling vaginal discharge, it was determined to empty the uterus, and a uterine culture taken before any manipulations were made. On examination the cervical canal admitted one finger; the uterus was enlarged, retroflexed, and softened in consistency. The fingers found numerous shreds of tissue in the uterine cavity, which were readily separated and removed with ovum forceps, after which a hot saline intrauterine douche was given. The following evening she had a severe chill and the temperature rose to  $103.8^{\circ}$ , after which it pursued a hectic course rising as high as  $105^{\circ}$ . The bacteriological examination showed streptococci in pure culture.

When I saw her five days after the uterus had been emptied, the abdomen was flat, no distention or tenderness, slight rigidity on the right side. Vaginal examination gave the same result as before the operation, except that a worm-like mass could be palpated in the outer portion of the right broad ligament.

From the history of the case, the continued hectic fever and the findings in the right broad ligament, thrombosis of the pelvic veins on the right side was diagnosticated, and it was determined to open the abdomen and remove or ligate the affected vessels.

This was done on February 28, one week after the uterus had been emptied and two weeks after the abortion. On opening the abdomen the uterus was found to be enlarged, retroflexed but not adherent, the appendages on the left side were perfectly normal; the right tube and ovary were likewise normal, but at the base of the right broad ligament was an indurated mass the size of a small orange, from the outer side of which a strand of firm, thick vessels extended to the pelvic wall. The right spermatic vein was then exposed and ligated above the induration, and the right iliac vessels exposed by an incision through the peritoneum, anterior and lateral to the promontory of the sacrum. A thrombosed vessel, apparently corresponding to Konatski's median iliac vein was found and ligated with catgut just before it opened into the external iliac. The peritoneal incision was then united by a continuous catgut suture, and the abdominal wall closed in layers in the usual manner. On remov-



ing the subcutaneous abdominal suture one week later the wound was found to have healed by first intention.

Following the operation there were no further chills, and the hectic fever gave place to a continuous temperature. Four days later the patient began to complain of pain and tenderness in the right ovarian region, and on the sixth day a definite mass could be palpated in the right lower quadrant of the abdomen. On the seventh day I found that it extended four fingers' breadth above Poupart's ligament, and on vaginal examination occupied the right broad ligament and completely filled out the anterior segment of the pelvic cavity. The left tube and ovary were normal and readily palpable.

Having diagnosed a broad-ligament abscess, the patient was prepared for operation on the following day, eight days after the abdominal section. An incision  $7\frac{1}{2}$  cm. long was made  $2\frac{1}{2}$  cm. above and parallel to Poupart's ligament, at whose lateral end the tissues were so indurated and matted together that it was impossible to distinguish their relations. Through this area the abscess was opened and a large quantity of thin, foul-smelling pus escaped. After enlarging the incision, the finger entered a cavity the size of two fists, which occupied the right broad ligament, its median side being bounded by the uterus and its lateral by the right pelvic wall. After washing out with sterile salt solution, the cavity was lightly packed with iodoform gauze and the median end of the incision closed by three layers of sutures.

The temperature immediately fell to normal, but rose to  $102\frac{1}{2}^{\circ}$  the next day and gradually subsided, becoming entirely normal two weeks after the operation. During this time the patient was very comfortable and her general condition very satisfactory. The wound granulated slowly, but was entirely healed within a month.

On discharge, April 21, the patient was in excellent condition.

CASE V.—Obst. No. 3613. Twilley. Admitted to hospital August 31, 1908. Twenty-seven years old, six children, two miscarriages, several instrumental labors. She has never been well, either during or outside of pregnancy. Last menstruation June, 1908. On admission the following history was obtained:

Seven days previously the patient, who thought herself about three months' pregnant, began to have abdominal pains which were followed two days later by a bloody discharge. At this time she had a chill, which has recurred daily. Three days ago her physician attempted to clean out the uterus without anesthesia and repeated the procedure the following day.

On admission the patient was very sick and toxic and had considerable abdominal pain. There was a profuse purulent foul-smelling blood-stained vaginal discharge; the abdomen was soft, but painful on palpation. On this account the possibility of peritonitis was considered and seemed to contraindicate

exploring the uterine cavity as would ordinarily have been done. An ice-bag was placed on the abdomen.

The following day she had a severe chill with a temperature of  $103.8^{\circ}$  and also complained of sticking pains in the left side of the chest which interfered with deep respiration. No friction sounds could be heard and the examination was generally negative. There was slight rigidity on the left side of the abdomen, and marked tenderness over the left iliac fossa. On vaginal examination the uterus was in midposition, and fairly well involuted. Appendages on the right side negative; on the left side there was a definite thickening in the broad ligament, which was most marked in the uterine margin; the tube could not be felt, but the ovary was normal in size and movable.

In view of the history of abortion followed by chills and the findings in the left broad ligament, thrombosis of the vessels on the left side was suspected and immediate operation seemed indicated on account of the presence of signs indicating early pulmonary involvement. Accordingly, the patient was operated upon the same day by Dr. H. J. Storrs, the resident obstetrician.

The abdomen was opened in the midline and after packing back the intestines a thickened mass was found at the inner margin of the left broad ligament. The left tube was freely movable, but swollen and congested; the left ovary as well as the right tube and ovary were normal; the uterus was slightly larger than usual with some old adhesions on its posterior surface. The peritoneum was then opened at the brim of the pelvis and the lower part of the left ovarian vein was found to be thrombosed, enlarged, and definitely involved in an inflammatory process. A catgut ligature was then applied beyond the area of thickening just above the pelvic brim, and the peritoneum covering it closed by a continuous catgut suture. The inflamed left tube was removed, but the ovary was left *in situ*, after which the abdomen was closed in layers in the usual manner.

The day following the operation the patient's condition was practically unchanged and no further chills occurred during convalescence. On the third day, however, the temperature rose to  $105.2^{\circ}$ , the respiration became much more rapid and difficult, reaching forty-four per minute and the abdomen was also somewhat distended. That afternoon tubular breathing was detected in the left lung, but no friction rub or signs of consolidation. On the fourth day, signs of lobar pneumonia were detected at the base of the left lung, which rapidly increased in extent so that the greater part of the lung had become consolidated by the following day. At the same time râles appeared in the right side.

As the patient's condition did not improve, the dressings were removed on the sixth day when it was found that the upper two-thirds of the abdominal wound had broken down and a loop of intestines was presenting through it. No attempt was made to reduce the latter and the wound was dressed with iodoform gauze.

Examination by the medical resident on the eighth day showed consolidation of the entire left lung and of the lower and posterior portion of the right lung. The following day the involvement of the right lung had materially increased, but the condition of the patient was somewhat improved. The temperature, however, varied between  $103^{\circ}$  and  $105^{\circ}$  and the pulse between 120 and 140 up to the fourteenth day. At that time there was critical fall in temperature to  $98\frac{1}{2}^{\circ}$  and thereafter it remained practically normal, reaching  $101^{\circ}$  only on two occasions.

When the wound was dressed at this time it was found to be granulating sluggishly and the coil of intestines was adherent to both sides of the incision. The wound healed slowly, but the patient improved rapidly and was discharged on October 26, in good condition. At that time the pleura over the left lung was evidently thickened; the uterus was well involuted, but drawn somewhat to the left of the mid line; the appendages on the right side were normal and there was no mass or tenderness on the left side; the abdominal wound was not completely healed, but was granulating satisfactorily.

On considering the history of the case it is not apparent that the operation played a marked part in the recovery of the patient, but both Dr. Storrs and Dr. Goldsborough who saw her in consultation felt that without it she would undoubtedly have perished. Cultures from the uterine cavity showed the presence of streptococcus, though blood cultures taken during the course of the disease were negative. Examination of the excised tube showed signs of perisalpingitis, considerable edema and congestion, but no evidence of acute salpingitis.

#### CONCLUSIONS.

1. As the average mortality of puerperal pyemia is in the neighborhood of  $66\frac{2}{3}$  per cent., any operation which offers a chance of reducing it should be welcomed.

2. This paper is based upon the study of fifty-six cases of thrombophlebitis treated by the excision or ligation of one or more pelvic veins. Fifteen operations by the extraperitoneal and forty-one by the transperitoneal method gave a gross mortality of 80 per cent. and 43.9 per cent., respectively. Not an appreciable difference from that following expectant treatment.

3. Many of the reported cases were not susceptible of cure, and the technic was often faulty. Upon deducting such cases we obtain a corrected mortality of 40 per cent. and 21.4 per cent. for the two types of operation. In five personal cases the gross mortality was 20 per cent.

4. When the thrombosis is limited to the spermatic veins the



mortality should not exceed 10 per cent., provided the operation is performed early, as compared with 25 per cent. when other vessels are involved.

5. Operation should be undertaken as soon as a positive diagnosis can be made, which is assured whenever a worm-like mass can be palpated at the outer portion of the broad ligament in patients suffering from chills and a hectic temperature.

6. Excision of the thrombosed vessels is rarely necessary and should be substituted for ligation only when the vessel appears likely to rupture or is surrounded by periphlebitic inflammation.

7. The transperitoneal is preferable to the extraperitoneal route. It is technically easier, affords a much more extensive view of the vessels, and with proper precautions scarcely increase, the likelihood of peritoneal infection.

8. The vaginal route suggested by Taylor, Latzo, and others is applicable only to a small class of cases in which the thrombotic process is limited to the vessels of the broad ligament. As such a diagnosis cannot be made, I consider that laparotomy should be done in all cases in which interference appears indicated.

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